

APPENDIX 2
AMENDED CLAIMS

The claims were amended by canceling Claims 1-12, 16-18, 22, 23, and 25, and incorporating the subject matter of these claims into the remaining claims. The patentee has renumbered remaining Claims 13-15, 19-21, 24, and 26 as Claims 1-8.

1. A method for the liquefaction of a feed gas which comprises providing at least a portion of the total refrigeration required to cool and condense the feed gas by utilizing

(a) a first refrigeration system comprising at least one recirculating refrigeration circuit, wherein the first refrigeration system utilizes two or more refrigerant components and provides refrigeration in a first temperature range; and

(b) a second refrigeration system which provides refrigeration in a second temperature range by work expanding a pressurized gaseous refrigerant stream;

wherein the first recirculating refrigeration system is operated by

- (1) compressing a first gaseous refrigerant;
- (2) cooling and at least partially condensing the resulting compressed refrigerant;
- (3) reducing the pressure of the resulting at least partially condensed compressed refrigerant;
- (4) vaporizing the resulting reduced-pressure refrigerant to provide refrigeration in the first temperature range and yield a vaporized refrigerant; and
- (5) recirculating the vaporized refrigerant to provide the first gaseous refrigerant of (1);

wherein at least a portion of the cooling in (2) is provided by indirect heat exchange with one or more additional vaporizing refrigerant streams provided by a third recirculating refrigeration circuit.

2. The method of Claim 1 wherein the third recirculating refrigeration circuit utilizes a single component refrigerant.

3. The method of Claim 1 wherein the third recirculating refrigeration circuit utilizes a mixed refrigerant comprising two or more components.

4. A method for the liquefaction of a feed gas which comprises providing at least a portion of the total refrigeration required to cool and condense the feed gas by utilizing

(a) a first refrigeration system comprising at least one recirculating refrigeration circuit, wherein the first refrigeration system utilizes two or more refrigerant components and provides refrigeration in a first temperature range; and

(b) a second refrigeration system which provides refrigeration in a second temperature range by work expanding a pressurized gaseous refrigerant stream;

wherein the second refrigeration system is operated by

(1) compressing a second gaseous refrigerant to provide the pressurized gaseous refrigerant in (b);

(2) cooling the pressurized gaseous refrigerant to yield a cooled gaseous refrigerant;

(3) work expanding the cooled gaseous refrigerant to provide the cold refrigerant in (b);

(4) warming the cold refrigerant to provide refrigeration in the second temperature range; and

(5) recirculating the resulting warmed refrigerant to provide the second gaseous refrigerant of (1);

wherein at least a portion of the cooling in (2) is provided by indirect heat exchange with one or more additional vaporizing refrigerant provided by a third recirculating refrigeration circuit.

5. The method of Claim 4 wherein the third recirculating refrigeration circuit utilizes a single component refrigerant.

6. The method of Claim 4 wherein the third recirculating refrigeration circuit utilizes a mixed refrigerant which comprises two or more components.

7. A method for the liquefaction of a feed gas which comprises providing at least a portion of the total refrigeration required to cool and condense the feed gas by utilizing

(a) a first refrigeration system comprising at least one recirculating refrigeration circuit, wherein the first refrigeration system utilizes two or more refrigerant components and provides refrigeration in a first temperature range; and

(b) a second refrigeration system which provides refrigeration in a second temperature range by work expanding a pressurized gaseous refrigerant stream;

wherein the first refrigerant system is operated by

(1) compressing a first gaseous refrigerant;

(2) cooling and partially condensing the resulting compressed refrigerant to yield a vapor refrigerant fraction and a liquid refrigerant fraction;

(3) further cooling and reducing the pressure of the liquid refrigerant fraction, and vaporizing the resulting liquid refrigerant fraction to provide

refrigeration in the first temperature range and yield a first vaporized refrigerant;

(4) cooling and condensing the vapor refrigerant fraction, reducing the pressure of at least a portion of the resulting liquid, and vaporizing the resulting liquid refrigerant fraction to provide additional refrigeration in the first temperature range and yield a second vaporized refrigerant; and

(5) combining the first and second vaporized refrigerants to provide the first gaseous refrigerant of (1);

wherein vaporization of the resulting liquid in (4) is effected at a pressure lower than the vaporization of the resulting liquid refrigerant fraction in (3), and wherein the second vaporized refrigerant is compressed before combining with the first vaporized refrigerant.

8. A method for the liquefaction of a feed gas which comprises providing at least a portion of the total refrigeration required to cool and condense the feed gas by utilizing

(a) a first refrigeration system comprising at least one recirculating refrigeration circuit, wherein the first refrigeration system utilizes two or more refrigerant components and provides refrigeration in a first temperature range; and

(b) a second refrigeration system which provides refrigeration in a second temperature range by work expanding a pressurized gaseous refrigerant stream;

wherein the second refrigeration system is operated by

(1) compressing a second gaseous refrigerant to provide the pressurized gaseous refrigerant in (b);

(2) cooling the pressurized gaseous refrigerant to yield a cooled gaseous refrigerant;

(3) work expanding the cooled gaseous refrigerant to provide the cold refrigerant in (b);

(4) warming the cold refrigerant to provide refrigeration in the second temperature range; and

(5) recirculating the resulting warmed refrigerant to provide the second gaseous refrigerant of (1);

wherein the feed gas is natural gas, the resulting liquefied natural gas stream is flashed to lower pressure to yield a light flash vapor and a final liquid product, and the light flash vapor is used to provide the second gaseous refrigerant in the second refrigerant circuit.